Sedimentary environment and sequence stratigraphy of the Asmari Formation in the Gachsaran

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Abstract

In this study, Asmari formation was investigated in Malaghoon valley in the east of Gachsarn town (Kohgilouyeh and Boyer Ahmad provience). The formation in this area (Ca. 351m thicknesses)composed of limestone and dolomitic limestone thin to thick layers. the formation laied on the Pabdeh formation and was covered by Gachsaran formation. According to microscopic and field study and based on lasemi (1979), Carrozi (1989) and Flugel (2004) method, 17 carbonate microfacies were distinguished.These microfacies were grouped in six facies belts. Based on Martin – chivelet method (2003) Three 3rd order sequence and their system tracts were recognized. Thick nesses of the sequence N.1(Ca.48m) is less than the sequence N.2 (Ca.256m), but the sequences is thicker than sequence N.3(Ca.64). These three sequence have a Progradational trending .In the other hand Tst thicknesses in each sequence is less than its Hst thicknesses,but average of parasequence thicknesses of Tst in each sequence is thicker Hst . there fore it can confirm the prograding of sequence.

Introduction

Asmari formation is a thick sequence of carbonate Oligo-miocene rocks. This formation was first named by Basque and Mayo (1918) after the mountain near Asmar in Khuzestan. The careful study of formation and introduction was performed by James and Wynd (1965). Adams and bourgeois (1967) divided the formation to three units of low Asmari (Oligocene age), middle Asmari (Early Miocene age - Aquitanian) and high Asmari (former Miocene age - Burdigaliam). The cutting under study is 15 kilometers East Gachsaran in Malaghoon with the geographic coordinates of 30*20'N/50*58'E(Appendix, Figure 1). The lower boundary of this is Pabdeh shale formation and the formation of the upper border is Gachsaran evaporation formation. Field information was recorded by Tucker (1990), Stowe (2005) and NBS / ISS (2003) methods. Grabu method (1913) was used to name field samples and simultaneously a systematic method - facies conducted to collect and index samples. 230 samples were collected and the thin plate of their information was made and by the help of Adams and Mackenzie (1998) and Flugle (1982 and 2004) the information was extracted and compared with Flugle (2004 and 1982) to calculate active percentage and eventually were named by Wright (1992) and Dunham (1962) method with modulation of Folk method (1962). Fine Facies were classified by Lasmy (1979) and carrozi (1989) method. After drawing column facies, to determine facies belt the desired fine facies were compared with Flugle proposed facies (2004). Then by the help of Walter (1844 in middletown

1973) and using Solely (1971 in Walker, 1983) fine Facies correlations were set and were compared with Flugle proposed model (2004) and similar environments (eg, Purser 1973, and Riding 1996). Sequence stratigraphy of Asmari formation of the research region was studied by Martin-Chivelt(2003),methodsrespectively.

Discussion

Facies description

By using the above methods, seventeen carbonate fine Facies were identified which belong to internal ramp to middle ramp. The fine facies are described below from shallow environment to deep.(Appendix).

Sequence stratigraphy

Using Martin - Chivelt (2003) method, three sedimentary sequences are obtained as follows:

1) The first sedimentary cycle

1 -1) describing Transgressive System Traracts of the first sedimentary cycle (TST1)

This collection of Parasequences with outer ramp facies related to Pabdeh formation started and includs thin layers plagic lime stone and calcareous shale.These Parasequences with a thickness of 17.2 m include fine facies of Wackstone/Packstone with Plagic foraminifera (Mf pd). The limiting level of this group is conducted by the maximum flooding surface (MFS1) which includes microfacies that have autigene glauconite . The average thickness of these Parasequences is about 8.6 meters .

1 -1-2 - interpretation Transgressive System Traracts of the first sedimentary cycle (TST1)

Due to the start of this category of parasequences within Pabdeh formation the process of these parasequences is not exactly clear. The presence of a glauconite as autigene in the foraminifer, phosphatization of allochems , condense beds in the sight of the field indicates the maximum levels of flooding surface (Flugle 2004), this symptoms level shows the end of this group.

1 -2 – The description of the first sequence of Highstand System Tract (HST1)

This collection of parasequences is located after the first maximum flooding surface (MFS1) and on top of this level are facies of MF16 and MF13 of middle ramp and open marine which are related to Asmari formations. This group of parasequences started with middle ramp facies MF16 and ends with MF5, 6. In this collection, parasequences from beginning to end have a shallowing trend. Thickness of these parasequences is 36 meters .This collection is limited by a second type of sequence boundary (SBII) (Van Wagner 1983 adaptation of Mial 1999).

1 -2-1 – Detailed descriptions of the first sedimentary cycle of the Highstand System Tract (HST1)

Normally after reaching the relative sea level to its maximum rate, the degree of upcoming of water continuously decreases in comparison to the sedimentation rate and shows prograding parasequences (co, and colleagues, 2003). In the same basin the same problem causes categories of prograding parasequences after the maximum flooding surface with the difference that this process of parasequences is first aggradation and in

the end terminates to prograding parasequences. The average thickness of parasequences of this section is about 7.4 meters

2 - Second sedimentary cycle

2 -1 - Detailed descriptions of the second sedimentary cycle of the Transgressive System Traracts(TST2)

This collection of parasequences is located after the first sequence boundary (SBII) (adapted from Van Wagner and colleagues, Mial 1999). It started with MF13 of the open marine and terminates with MF12 of the open marine. The thickness of this section of the HST parasequences is about 97.3m .The limiting border of this section is the second maximum flooding surface(MFSII) which are at the end of the open marine Mf12.

2 -1-2 – Comments on the second sedimentary cycle of the Transgressive System Traracts (TST2)

Second sequence retrograding parasequences are on the border of the type two that shows the formation of this sequence in the deeper parts of the basin. Parasequences process in this section is like the former Tst with the difference that at first the process matches and at the end they enter into a retrogradation process. The average thickness of parasequences is about 19.26 meters.

2-2 The description of the second sedimantary sequence of Highstand System Tract (HST 2)

This collection of parasequences is located after the second maximum flooding surface level (MFS II) and on this level of fine Mf13 open marine facies is placed. HST thickness of this sequence is 158.7 meters and is limited by the second sequence border.

2-2-1 Comments on the second sedimantary sequence of Highstand System Tract (HST 2)

Sedimentation space changes and sedimentation rate is as before Hst, but here sedimentation begins with MF13 of open marine and ends with MF3 pretidal zone and is considered as SB1, indicating that this Hst is more prograding than former Hst. Border sequence type one is a kind of reason to show the exit of water out of the study area from the water level at the time of partial decline of marine and it will be determined by calich facies. Parasequences process of this section is at first a deepening process and then matching and at the end prograding. The average thickness of these parasequences section is about 10.8 m .

3) The third sedimentary cycle

-3 Detailed descriptions of the third sedimentary cycle of Transgressive System Traracts (Tst3)

This collection of parasequences are separated from the second sequence by the sequence border. This collection of parasequences starts on the whole with open marine MF13 and ends with MF14 open marine. Thickness of parasequences of this section is about 41.2 meters . The limiting border of by this section is the maximum flooding level (MFS III) which is determined by MF14 of the open marine.

3-3-1 Comments on the third sedimentary cycle of the Transgressive System Traracts (TST3)

TST process is like the sequence of other TST process, the difference is that first it is prograding and in the end it becomes retrograding. The average thickness of the parasequences of this section is about 11 meters .

3-4 Explanation of the third sedimentary cycle of the of Highstand System Tract (HST3)

This parasequence begins after the third maximum flooding surface (MSF III). And is located on the MF5, 6 level. Thickness of the HST sequence is about 22.8 m, which is limited by the third sequence boundary.

3-4-1 interpretations and Comments on the third sedimentary cycle of the of Highstand System Tract (HST3)

This group of parasequences also have a prograding process and start with MF5, 6 and are covered with Gachsaran Evaporate Formation sediments. This sequence border is considered as the first type of sequence boundary. Hst process is long so that first there is matching case then suddenly changes to retrograding mode, then again matching mode and again in the final state prograding is shown. The average thickness parasequences of this section is about 3 meters.

Conclusion

-Asmari formation is located on Pabdeh formation and Gachsaran formation.
-Carbonate rocks of this formation can be divided into 17 micro facies.
-The 3 fine facies are related to pretidal facies belt, a fine facies belonging to a belt facies of Lagoon, 2 facies belonging to the bar belt, 3 facies belonging to restricted marine, 5 facies belonging to facies belts of the open marine and 3 micro facies belonging to facies belts of the middle ramp.
-All these facies have been gathering in a hemoclinal ramp (A. Fig. 3).
-Sediments of the Asmari sedimentary basin formation have been deposited during three degrees sedimentary cycle respectively, with thicknesses of 48 m, 256 m and 64 m,(A. Fig. 2).
-Each cycle of Transgressive System Traracts (TST) and Highstand System Tract (HST) will be formed.
-In total, thickness of Transgressive System Tracts facies (TST) is less than Highstand System Tract facies HST . Thickness of the mean categories of parasequences in Transgressive System Traracts facies (TST) is higher than the average thickness o f Highstand System Tract facies categories (Hst,a. - facies of the first sedimentary cycle third degree mainly related to the middle ramp and open marine . Second sedimentary cycle third degree related to the sedimentary belt of micro facies limited to open marine and third sedimentary cycle third degree related to the sedimentary belt of micro facies limited to restricted marine and open marinewhich all show reducing of the dep th and balance relative sea level fall down from the beginning to the end to the formation.in this basin is Condition such that in the second cycle suitable situations occurred for the formation of boundstone, however these boundstones did not develop much and have been formed as patch reef .

Microfacies name	Facies No	Main Elements	Sub Elements
Crystal	Mf1	Micrite	The mold
Biommolding	Mf2	Micrite	The mold
Calich	Mf3	Calich	——

Microfacies name	Fcei s No	Main Elements	Sub Elements
Mud stone	Mf4	Micrite	Algae filament

C-Bar microfacies

D-Restricted marine microfacies

Microfacies name	F.NO	Main Elements	Sub Elements
Plagic Foraminfer Mudstone	Mf15	Micrite	Plagic Forams,Hialin Forams fragments
Bryozoa wackstone	Mf16	Bryozoa	Plagic Foram,Large Foram,
Limestone Conglomerate	Mf17	Lime graines	Matrix

Microfacies name	F.No	Main Elements	Sub Elements
Large Foraminfer grainstone	MF5	*Large Foraminfer*	RedAlge, Echinoderm
Mollusca grainstone	MF6	Mollusca	Cement, mud, Peloid

E-Open marine microfacies

E –Open marine environment microfacies

microfacies name	F.No	Main Elements	Sub Elements
Boundstone	Mf10	Coral frame	RedaAlge
Floatstone	Mf11	Coral fragments	Benthic foram,Bryozoa
Roudstone	Mf12	Coral fragments	RedAlge
Large Foraminfer wackstone/packstone	Mf13	Large Foraminfera	RedAlge, foram,Bivalve
RedAlge wackstone/packstone	Mf14	RedAlge	Planktonic Forams

B-Lagoon microfacies

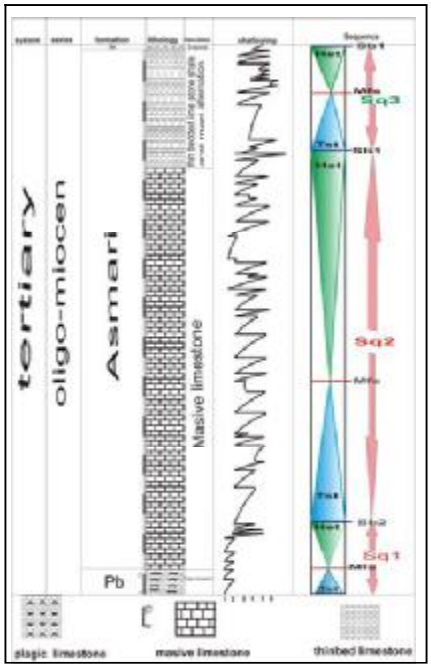

Fig2.stratigraphy column of the Asmari Formation in the study area

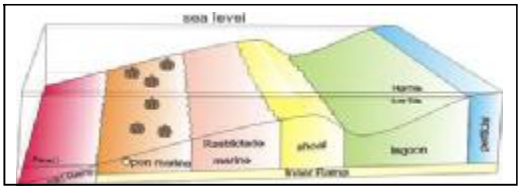

Fig3.sedimentary model in the study area

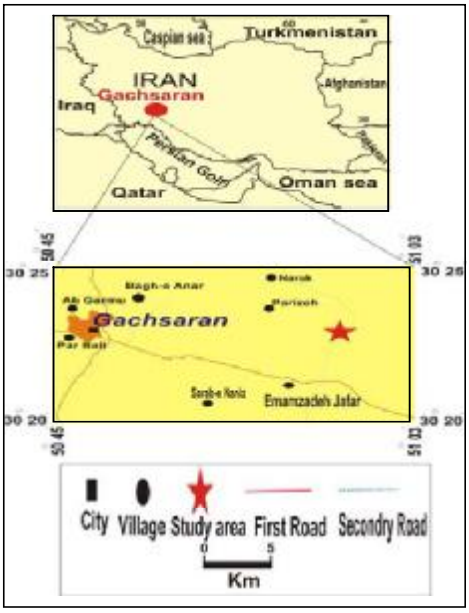

Fig1.The map of study area

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